United States Government Accountability Office

GAO

Report to the Ranking Member, Committee on Banking, Housing, and Urban Affairs, U.S. Senate

October 2008

FLOOD INSURANCE

FEMA's Rate-Setting Process Warrants Attention

GAO-09-12

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Highlights

Highlights of GAO-09-12, a report to the Ranking Member, Committee on Banking, Housing, and Urban Affairs, U.S. Senate

Why GAO Did This Study

Questions about the financial status of the National Flood Insurance Program (NFIP) have increased since the 2005 hurricanes, which left the program with an unprecedented $17.4 billion deficit—a debt that resulted in GAO placing NFIP on its high-risk list in March 2006. Among the concerns are the subsidized rates NFIP must provide for about 25 percent of the policies, mostly for older buildings in high-risk flood zones. And although fully risk-based rates are supposed to reflect actual flood risk, concerns have been raised that they do not. This report evaluates (1) the Federal Emergency Management Agency's (FEMA) process for setting full-risk rates to determine whether it produces rates that accurately reflect the risk of flooding and (2) the process that FEMA uses to set subsidized rates and their effect on the financial condition of NFIP. To do this work, GAO evaluated the NFIP rate model, examined data from FEMA, surveyed relevant literature, and interviewed other relevant agencies and risk-modeling firms.

What GAO Recommends

GAO recommends that FEMA (1) ensure that its rate-setting methods result in rates that accurately reflect flood risks and (2) collect data to analyze the impact of newly created grandfathered properties on the NFIP. FEMA generally concurred with both recommendations but expressed two reservations with our recommendation regarding rate setting.

To view the full product, including the scope and methodology, click on GAO-09-12. For more information, contact Orice M. Williams at (202) 512-8678 or williamso@gao.gov.

What GAO Found

FEMA's method for setting its full-risk rates may not ensure that the rates accurately reflect the actual risk of flood damage. The NFIP model combines estimated flood risk with expected flood damage, but a number of factors may affect the accuracy of the rates the model generates. First, some data inputs are outdated or inaccurate. FEMA relies on flood probabilities from the 1980s and damage estimates that do not fully reflect recent NFIP damage experience. Moreover, while FEMA has made updating its flood maps a priority, most of the maps used in rate setting have not yet been updated. Second, FEMA does not require all properties remapped into higher-risk areas to pay rates based on the new designation. This policy, known as grandfathering, erodes NFIP's ability to charge rates that reflect the risk of flooding. The policy is intended to increase participation, but FEMA does not track the number of grandfathered properties and cannot determine their financial impact on the program. Third, FEMA uses a nationwide rating system that combines flood zones across many geographic areas, so individual policies do not always reflect topographical features that affect flood risk. In fact, some patterns in historical claims and premium data suggest that NFIP's full-risk rates may not always reflect actual flood risk. Collectively, these factors increase the risk that premiums collected on full-risk policies may be insufficient to cover future losses, adding to concerns about NFIP's financial stability.

FEMA's rate-setting process for subsidized properties depends in part on the accuracy of the full-risk rates, raising concerns about how these rates are calculated as well. To set subsidized rates, FEMA first subtracts the total amount it expects to collect in full-risk premiums from the average historical loss year—that is, the minimum (target) amount that the program needs to collect from all premiums to cover at least average annual losses, as determined by historical data. The remainder becomes the aggregate target amount the program must collect in subsidized premiums. To set individual subsidized rates, FEMA officials then consider their knowledge of flood risk, previous rate increases for various locations, and statutory limits on increases. The resulting subsidized premiums continue to be a financial strain on the NFIP and contribute to its ongoing financial instability. Evidence suggests that flooding is likely to become more severe in the future, resulting in increased risk exposure, the potential for more catastrophic losses, and ongoing financial instability for the program. Currently, the annual amount that NFIP collects in both full-risk and subsidized premiums is not enough to cover its operating costs, claim losses, and principal and interest payments to the Department of the Treasury, thereby exposing the federal government and ultimately taxpayers to ever-greater financial risks, especially in years of catastrophic flooding.

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Abbreviations

BFE	base flood elevation
CBO	Congressional Budget Office
CRS	Congressional Research Service
DELV	damage by elevation
DHS	Department of Homeland Security
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
GAAP	Generally Accepted Accounting Principles
GDP	gross domestic product
NFIP	National Flood Insurance Program
PELV	probability of elevation
SFHA	Special Flood Hazard Area

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United States Government Accountability Office
Washington, DC 20548

October 31, 2008

The Honorable Richard C. Shelby
Ranking Member
Committee on Banking, Housing,
and Urban Affairs
United States Senate

Dear Senator Shelby:

As of June 2008, the National Flood Insurance Program (NFIP) owed approximately $17.4 billion to the U.S. Treasury, primarily as a result of loans that the program received to pay claims resulting from the 2005 hurricane season. According to the Federal Emergency Management Agency (FEMA) of the Department of Homeland Security (DHS), which administers the program, this debt is greater than the sum of all previous losses since the program's inception in 1968. Until 2004, NFIP was able to cover most of its losses with the premiums it collected and occasional loans from the Treasury that were either repaid or retired by Congress. However, after the 2005 hurricanes—primarily Hurricane Katrina—the program borrowed $16.8 billion from the Treasury to cover the enormous number of claims. As a result, in part because of the level of indebtedness, we placed NFIP on our high-risk list in March 2006.[1]

As a result of this unprecedented deficit, questions have been raised about the fiscal sustainability of the flood insurance program, particularly given the potential for similar natural disasters in the future. Congress and others have raised questions about the scope of the information and quality of the data on which the program relies to set premium rates and the accuracy of the maps NFIP uses to assess the risk of flooding.[2] FEMA's process for setting premium rates determines how much policyholders will pay for their flood insurance policies and thus the income available to FEMA for losses and expenses. By statute, NFIP was not designed to be actuarially sound. Premium rates for most properties—around 75

[1]GAO, *High-Risk Program: National Flood Insurance Program*, GAO-06-497T (Washington D.C.: Mar. 15, 2006).

[2]To assess the risk of flooding, FEMA uses Flood Insurance Rate Maps (FIRM) that show the level of flood risk in communities that participate in NFIP.

percent—are intended to fully reflect the risk of flooding, but the remaining 25 percent are subsidized, as mandated by statute. While these subsidized premiums do not contribute sufficient revenues to cover potential losses, according to FEMA officials, they promote participation in the program, an important program goal. But as a result, the program does not collect sufficient premium income to build capital to cover flood losses.

In response to the questions that have been raised about NFIP's financial condition, this report evaluates (1) FEMA's process for setting full-risk premiums to determine whether it produces rates that accurately reflect the risk of flooding and (2) the process that FEMA uses to set subsidized rates and their financial impact on NFIP.

To address these objectives, we obtained and reviewed FEMA's flood risk model and related methods for assessing risk and setting premium rates for policyholders. We discussed FEMA's method for setting rates with officials from FEMA, the National Oceanic and Atmospheric Administration, U.S. Army Corps of Engineers (the Corps), and the U.S. Geological Survey. We also met with risk-modeling firms, academics, and the American Academy of Actuaries and reviewed studies of flood risk and flood insurance, including reviews from the Congressional Research Service (CRS) and the Congressional Budget Office (CBO). We also analyzed premiums received and losses paid by NFIP for the period from 1978 to 2007. We assessed the reliability of these data, and found them to be reliable for the purposes of this report. In addition, we obtained and reviewed information on FEMA's current and past borrowings and repayments. We also analyzed FEMA's premiums and claims data to determine the number of high-loss years on a state-by-state basis in order to assess each state's financial impact on NFIP. In order to conduct the state loss analysis, we reviewed the claims and premium data from NFIP's BureauNet database.[3] Appendix I provides additional details about our scope and methodology.

We conducted this performance audit from December 2007 to September 2008 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for

[3]BureauNet is the system that FEMA uses to collect, manage, and access its policy, claims, and policyholder data.

our findings and conclusions based on our audit objectives. The evidence we obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Results in Brief

FEMA's method for setting full-risk rates may not ensure that the rates accurately reflect the actual risk of flood damage.[4] FEMA's model for setting these rates incorporates data on flood risks generated by a hydrologic model that is based on largely the same principles as hazard risk models used by private insurers and other federal agencies.[5] More specifically, FEMA generates rates for flood insurance according to estimates of flood risk and expected flood damage. However, a number of factors may affect the accuracy of rates generated by the process. First, the data that FEMA uses to define flood probabilities are outdated or inaccurate. For example, some of the data used to estimate the probability of flooding have not been updated since the 1980s. Similarly, the claims data used as inputs to the model may be inaccurate because of incomplete claims records and missing data. Further, the maps FEMA uses to set premium rates remain substantially out of date despite recent modernization efforts. In addition, an NFIP policy decision allows certain properties remapped into riskier flood zones to keep their previous lower rates, which, like subsidized rates, do not reflect the actual risk of flooding to the properties and do not generate sufficient premiums to cover

[4]We use the term "full risk" to describe rates that FEMA refers to as "actuarial." These are the risk premium rates specified in the National Flood Insurance Act of 1968, which FEMA maintains accurately reflect flood risk and thus are not explicitly subsidized—that is, these rates contemplate the full range of loss potential including catastrophic levels, according to FEMA. The National Flood Insurance Act of 1968, as amended, is codified at 42 U.S.C. §§ 4001 *et. seq.*

[5]A hydrologic model is a static or dynamic representation of the process that affects surface water runoff. Hydrologic models are used to describe present conditions or predict future behavior of the hydrologic regime at a specific area of land that "caches" and "releases" surface water runoff (referred to as catchment.) Examples of hydrologic model inputs are precipitation and snow melt and example outputs are stream discharge and evapotranspiration. According to insurance market participants, to generate the loss estimates, private insurance companies and state authorities use models, which are computer programs with large databases that catalog the past incidence and severity of natural catastrophes, as well as proprietary insurance company data on policies written in particular states or areas. Using the estimates provided by these computer programs, insurers can attempt to manage their exposures in particular high-risk areas. See GAO, *Catastrophe Risk: U.S. and European Approaches to Insure Natural Catastrophe and Insurance Risks*, GAO-05-199 (Washington, D.C.: Feb. 28, 2005)

expected losses.[6] Moreover, FEMA does not collect data on these properties—known as grandfathered properties—or measure their financial impact on the program and does not know how many of these properties exist, their exact location, or how much they generate in losses. FEMA's rate-setting process also does not fully take into account ongoing and planned development, long-term trends in erosion, or the effects of global climate change, although private sector models are incorporating some of these factors. Finally, FEMA sets flood insurance rates on a nationwide basis, combining and averaging many topographic factors that are relevant to flood risk, so that these factors are not specifically accounted for in setting rates for individual properties. Moreover, some patterns in historical claims and premium data suggest that NFIP's rates may not accurately reflect differences in flood risk. Collectively, these factors increase the risk that full-risk premiums may be insufficient to cover future losses, adding to concerns about NFIP's financial stability.

FEMA's rate-setting process for subsidized properties depends in part on the accuracy of the full-risk rates, raising concerns about how subsidized rates are calculated as well. To determine subsidized rates, FEMA first subtracts the total amount that it expects to collect on full-risk rate premiums from the average historical loss year target. This target is the minimum amount of premiums the program needs to collect to cover at least average annual losses, as determined by historical loss data. The amount remaining from this calculation is the aggregate target amount of subsidized premiums that the program needs to collect. To set individual subsidized rates, FEMA officials then consider their knowledge of flood risks, previous rate increases for various areas, and statutory limits on increases. According to FEMA documents, the method for determining the average historical loss year target was changed in 2006 because fully incorporating the 2005 loss year, with its catastrophic losses, would have resulted in substantial increases in subsidized rates. Currently, the annual amount that NFIP collects in both full-risk and subsidized premiums is not enough to cover its operating costs, claim losses, and principal and interest payments to the Department of the Treasury. Evidence suggests that flooding is likely to become more severe in the future, resulting in increased risk exposure, the potential for more catastrophic losses, and ongoing financial instability for the program. Without changes to its current rate-setting processes, NFIP premiums will be unlikely to be able

[6]A flood zone is an area that is designated to have a predicted likelihood of experiencing flood damage.

to cover the program's claims, expenses, and debt, exposing the federal government and ultimately taxpayers to ever-greater financial risks, especially in years of catastrophic flooding.

This report makes two recommendations aimed at helping improve NFIP's rate-setting process. First, we recommend that FEMA take steps to ensure that its rate-setting methods and data used to set rates result in full-risk premiums rates that accurately reflect the risk of losses from flooding. Second, we recommend that FEMA collect information on the location, number, and losses associated with existing and newly created grandfathered properties and analyze the financial impact of these properties on the program.

We provided the Secretary of Homeland Security with a draft of this report for review and comment. On October 14, 2008, FEMA provided written comments on a draft of this report (see appendix III). FEMA generally concurred with both of the report's recommendations but had two reservations about our recommendation to ensure that FEMA's rate-setting methods result in full-risk rates that accurately reflect the risk of losses from flooding. FEMA also took exception to some of our analyses and characterizations, which it believes overstate the potential effect of different factors on the accuracy of the rate-setting process. While we acknowledge the complexity of FEMA's rate-setting process, the issues we have identified raise questions about the accuracy of the resulting premium rates and highlights areas that warrant additional analysis by FEMA. FEMA's comments are summarized near the end of this report, and FEMA's letter is reprinted in appendix III. FEMA also provided us with technical comments, which we incorporated as appropriate.

Background

NFIP is a federal program created by the National Flood Insurance Act of 1968 that enables property owners in participating communities to purchase insurance protection against losses from flooding. This program is administered by FEMA. Participation in NFIP is based on an agreement between local communities and the federal government. The federal government makes flood insurance available to any community that adopts and enforces a floodplain management ordinance to reduce future flood risks to new construction in areas known as Special Flood Hazard

Areas (SFHA).[7] Property owners located in the SFHA with mortgages from federally regulated lenders are required to purchase and maintain flood insurance policies. In these areas, new construction and substantial improvements must conform to NFIP's building standards.[8] For example, the lowest floor of a structure must be elevated to or above the base flood elevation (BFE)—the level at which there is a 1 percent chance of flooding in a given year.[9]

NFIP offers two types of flood insurance premiums: subsidized and full risk. The National Flood Insurance Act of 1968 requires that NFIP offer subsidized premiums to owners of certain properties. These subsidized rates are not based on flood risk and, according to FEMA, represent only about 35 to 40 percent of the full flood risk. Subsidized properties account for about 25 percent of all NFIP policies, while those with full-risk premiums account for the remaining 75 percent. The type of policy and the subsequent rate a policyholder pays depend on several property characteristics—for example, whether the structure was built after or prior to the development of the community's Flood Insurance Rate Map (FIRM) and where the structure is located relative to the floodplain. NFIP studies and maps flood risks, assigning flood zone designations based on the risk level for flooding. For our purposes, in this report we generally refer to risk levels as moderate- to low-risk, high-risk, high-risk coastal, and undetermined risk.[10] Potential policyholders can purchase both

[7]SFHAs, which are depicted on NFIP maps, represent the land area that would be submerged by the floodwaters of the "base," or 1 percent annual chance of flood. The SFHA is also referred to as the 100-year or 1 percent floodplain. NFIP's floodplain management regulations must be enforced in, and the mandatory purchase of flood insurance applies to, SFHAs.

[8]A substantial improvement is any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure before the "start of construction" of the improvement. If a building is "substantially damaged" or "substantially improved," it must be brought into compliance with local flood damage prevention regulations, including elevating the building to or above the 100-year flood elevation.

[9]The BFE is the elevation relative to mean sea level at which there is a 1 percent chance of floodwaters rising in a given year. The level of the BFE within a community can change throughout the floodplain.

[10]Some programs are also designated as having Emergency Program status. The Emergency Flood Insurance Program is intended as a program to provide a first layer amount of insurance on all insurable structures before the effective date of the initial FIRM.

building and contents flood insurance for residential and commercial properties (table 1).[11]

Table 1: Amounts of NFIP Insurance Available, as of May 1, 2008

		Regular program		
Type of coverage	Emergency program	Basic limit	Additional limit	Total limit
Building coverage				
Single-family dwelling	$35,000	$50,000	$200,000	**$250,000**
Two- to-four-family dwelling	35,000	50,000	200,000	**250,000**
Other residential	100,000	150,000	100,000	**250,000**
Nonresidential	100,000	150,000	350,000	**500,000**
Contents coverage				
Residential	10,000	20,000	80,000	**100,000**
Nonresidential	$100,000	$130,000	$370,000	**$500,000**

Source: NFIP rate manual.

Note: Alaska, Hawaii, Guam and the U.S. Virgin Islands have different amounts of coverage for the first and second layers of coverage; however, their total limit is also $250,000. The Emergency Flood Insurance Program is intended as a program to provide a first layer amount of insurance on all insurable structures before the effective date of the initial FIRM.

Congress mandated the use of subsidized premiums to encourage communities to join the program and mitigate concerns that charging rates that fully and accurately reflected flood risk would be a burden to some property owners. The Flood Disaster Protection Act of 1973 made the purchase of flood insurance mandatory for the protection of properties within SFHAs that are secured by mortgages from federally regulated lenders, thus expanding the use of subsidized premiums. In addition, NFIP was authorized to begin charging full-risk premiums for all construction built after 1974 or the date of the community's initial FIRM. According to FEMA, Congress made these changes to encourage further participation in NFIP through low premiums. More recently, legislation has been

[11]The rate-setting methods discussed in this report are used for the building structure as well as the insured's personal belongings, or the "contents," contained within the structure. Rates differ for these types of coverage, and insurance buyers specifically purchase each type of coverage in order to be covered for both. However, most of our discussion focuses on coverage for the structure.

introduced that would limit NFIP subsidies aimed at improving the financial stability of the program.[12]

Pre-FIRM structures generally are more prone to flood damage (that is, riskier) than structures built later because they were not constructed according to the program's building standards. Owners of post-FIRM structures generally are not eligible to receive subsidized rates. Largely because subsidized properties tend to be riskier than properties insured at full-risk premiums, in 2007, the average annual premium for a subsidized policy was about $869, while the average annual premium for a full-risk policy was about $378.[13] Flood insurance rates are calculated for each flood zone. However, as shown in table 2, flood insurance rates also depend on flood zone.

Table 2: Average Premium per Policy in Force by Flood Zone, 1997-2006

(In constant 2006 dollars)

Calendar year	High-risk	High-risk coastal	Moderate- to low-risk	Undetermined risk level
1997	$521	$1,039	$377	$794
1998	538	1,041	384	814
1999	525	1,053	380	824
2000	497	1,049	363	788
2001	482	1,059	350	766
2002	472	1,118	343	775
2003	478	1,232	349	824
2004	492	1,343	344	842
2005	502	1,398	340	912
2006	$521	$1,463	$336	$980

Source: GAO analysis of NFIP data.

The insurance operations of NFIP differ from those of most private insurers in a number of ways. First, unlike private insurers that can reject applicants with properties whose potential losses would not be offset by

[12]The Flood Insurance Reform and Modernization Act, H.R. 3121, 110th Cong. (2007) and the Flood Insurance Reform and Modernization Act, S. 2289, 110th Cong. (2007), both include provisions aimed at limiting subsidized properties.

[13]Various factors such as flood zone, structure elevation, type of structure, and amount of coverage affect the premiums.

premiums, NFIP is required to accept virtually all applications for insurance. Therefore, NFIP is less able to offset the effects of adverse selection—that is, the phenomenon that those who are most likely to purchase insurance are also most likely to experience losses.[14] Adverse selection may lead to a concentration of policyholders in the riskiest areas; the problem is compounded by the fact that those at greatest risk are required to purchase NFIP insurance if they have a mortgage from a federally insured lender.

Second, NFIP's ability to adjust premiums is limited by statute. While most states regulate premium prices, they tend to allow private insurers considerable flexibility in their ability to set prices. Third, NFIP assumes all the risks for the policies it sells. Private insurers typically retain only part of the risk that they accept from policyholders, ceding a portion of the risk to reinsurers.[15] This mechanism is particularly important in the case of insurance for catastrophic events, because the availability of reinsurance allows an insurer to limit the possibility that it will experience losses beyond its ability to pay.

Finally, NFIP is not authorized to charge premiums that are sufficient to build the capital that most private insurers have to offset losses or purchase reinsurance in the private global market. For example, private insurers have a capital surplus that they use to pay expected claims. In contrast, NFIP operates on a cash flow basis, backed by borrowing authority from the U.S. Treasury. As a result, NFIP does not follow all of the traditional accounting practices that private insurers use—for example, NFIP reports using only Generally Accepted Accounting Principles (GAAP) accounting, which is an ongoing operations accounting basis, while private insurers must report both GAAP and statutory accounting basis.[16]

[14]Adverse selection occurs when insurers cannot distinguish between less risky and more risky properties, although homeowners can. When premiums do not reflect differences in risk that are known to potential policyholders, those who buy insurance are often those at greatest risk for the hazards covered. Adverse selection in the market for natural catastrophe suggests that homeowners who are at the highest risk of experiencing a natural catastrophe will buy available insurance.

[15]Reinsurance is essentially insurance for insurers—that is, companies buy coverage for all or a part of a policy's liability from other insurers in order to offset exposure.

[16]This is on a conservative basis required by state insurance regulators.

FEMA's Method of Setting Full-Risk Premiums May Not Ensure That Rates Accurately Reflect Risk

FEMA uses a rate model to generate prices for flood insurance according to flood risk and expected flood damage. However, we found that in some cases these full-risk premiums may not accurately reflect actual risk because of limitations in the data used as inputs for the model and the effects of certain policy decisions. For instance:

- Some data FEMA used in rate setting are outdated or inaccurate, including data on flood probabilities, damage estimates, and flood maps.
- FEMA allows some properties that were remapped into riskier flood zones to keep their previous lower rates.
- FEMA's rate-setting process does not fully take into account ongoing and planned development, long-term trends in erosion, and effects of global climate change.
- FEMA sets rates on a nationwide basis, combining and averaging across many geographically diverse areas.[17]

Furthermore, our analysis of the difference between claims payments and premiums collected for all 50 states and the District of Columbia suggests that NFIP's pricing has not accurately reflected differences in flood risk. Collectively, these factors increase the risk that premiums collected on full-risk rates do not accurately reflect the risks of flooding and therefore may not be sufficient to cover future losses.

[17]Two properties that are of the same NFIP risk class (for example, both are one-story, single-family homes with no basement and are elevated a certain number of feet above a reference level) are charged the same rate per $100 of insurance although they may be located in different states with differing flood experiences or rest on different topography such as a shallow floodplain versus a steep, mountainous valley.

FEMA's Rate-Setting Process Uses a Model That Is Based on Flood Risk and Expected Flood Damage

According to FEMA, rates that are based on the probability of a given level of flooding, damage estimates based on that level of flooding, and accepted actuarial principles are considered to be "full risk."[18] To set rates for flood insurance that accurately reflect risk, information about the differential risk of flooding is key, with greater flood risks resulting in higher rates. Rates also vary depending on how much insurance is purchased. As claims are more likely to be made against the first several thousand dollars of coverage than against much higher levels of coverage (that is, smaller dollar-value losses are generally expected to occur more frequently than larger ones and thus pose a greater risk), rates per $100 of insurance coverage are lower for higher levels of coverage.[19]

FEMA uses a model to set rates for flood insurance for post-FIRM construction within the 1 percent, or 100-year, floodplain according to flood risk and expected resulting flood damage.[20] This method of estimating flood damage is based on the hydrologic model described in a 1966 report by the Department of Housing and Urban Development, which was based on studies conducted in the 1960s and developed and used by

[18]A premium system for a given insurance coverage typically takes into account expected claims costs, based on projections from relevant, credible prior experience; the administrative cost of providing the coverage, including but not limited to underwriting, sales, and claims administration; and, a margin for profits and for losses that are worse than expected. In addition, for a rate-setting system to be considered actuarially based, the premium charged to each insured should be reasonably related to the risk posed by coverage of that insured.

[19]For example, for a given property type, the rate per $100 of insurance on the first $50,000 of coverage for a single-family structure in the Regular Program (that is, what NFIP terms "basic" coverage) is $1.31. The rate per $100 of insurance on amounts in excess of $50,000 (that is, what NFIP terms "additional" coverage) is $0.10.

[20]The "1 percent annual chance flood," also known as the "100-year flood," is a statistical construct: It is a flood that has a certain discharge that produces a specific flood elevation and an estimated 1 percent chance of occurrence in any one year. In reality, the 1 percent flood represents a range of discharge and elevation values because of the uncertainties and other limitations in the information available for its computation and the resulting need to use specific types of probability distributions to portray the possibilities. The SFHA flood zones on the FIRMs can reflect varying degrees of analysis, in some cases using approximate methods while in others using more detailed methods. The accuracy of the flood hazard data depicted on the FIRMs and the delineation of the SFHA are dependent on the data limitations of the computation of the 1 percent flood and the topographic information available for the area being mapped. The variety of factors and uncertainties involved in generating flood maps render these maps less definitive and authoritative than communities frequently assume them to be—for example, many interpret the 1 percent flood line as an assurance that development above that elevation or outside that line is guaranteed to be safe from the 1 percent flood. The 1 percent flood zones reflect only existing conditions and not future development.

the Corps for a number of years.[21] While the Corps has revised its model for estimating flood damage, it still makes use of the hydrologic model to estimate flood damage.

In the high-risk and high-risk coastal zones, the model combines estimates of the frequency of flooding with estimates of the magnitude of damage caused by flooding, producing "pure premium" costs intended to cover the actual flood losses. FEMA uses such inputs as the elevation of the lowest floor of the building, the type of building, the number of floors, the presence of a basement, claims data, and mapping information to generate the estimates. This pure premium amount is then adjusted to capture certain program costs, compensate for underinsurance by policyholders, and reflect the fact that the program has a deductible.[22] For the moderate- to low-risk and other full-risk premium zones, rates have been developed based on actuarial and engineering judgments, using the rates generated by the model and the historical experience of the high-risk zones as benchmarks.[23]

While other entities employing flood models may use more sophisticated computer modeling techniques, the NFIP rate model is based largely on the same principles. In 2000, FEMA completed a feasibility study on using private market reinsurance to cover a portion of its flood risk that required modeling the frequency and size of catastrophic flood events, and determined that the results of the study were not inconsistent with the results of NFIP's rating structure. For other lines of catastrophe insurance, private insurers rely heavily on computer models of simulated damage

[21]U.S. Department of Housing and Urban Development, "Insurance and Other Programs for Financial Assistance to Flood Victims: A Report from the Secretary of the Department of Housing and Urban Development to the President, as Required by the Southeast Hurricane Disaster Relief Act of 1965," Public Law 89-339, 89th Congress, H.R. 11539, Nov. 8, 1965 (Washington, D.C.: August 1966).

[22]Property owners are underinsured when they purchase insurance coverage for less than the value of the property, either by or because of limits on the amount of available coverage. To compensate for this possibility, FEMA increases premium rates by an "underinsurance factor" that is based on claims data going back to 1978 for different zones and types of structures. More recent experience is given a greater weight in determining the factors.

[23]FEMA has taken this approach for pricing in these zones because it believes the cost of obtaining the information necessary to develop detailed flood frequency-magnitude relationships for use in the hydrologic model would be extremely high in relation to the benefits.

over many possible events to price their products.[24] Like NFIP, other federal agencies and private insurers involved in flood modeling also rely on flood maps and data on the likelihood of flooding and damages. According to FEMA, it has contracted for actuarial services with an external consultant to assess the current state of hazard modeling and the possible applicability of those models to NFIP.

Some Key Data Elements Used in the Rate-Setting Model Are Outdated or Based on Erroneous Information

Questions remain about the age and quality of the underlying data FEMA uses in its model to calculate full-risk premiums. The NFIP model for setting full-risk premium rates relies on flood probability estimates and expected damage data, which rely in part on outdated or potentially inaccurate information, including outdated FIRMs. As discussed more fully below, flood probability estimates have not been updated since the 1970s and 1980s, most FIRMs are out of date despite FEMA's recent modernization efforts, and the claims data used to calculate full-risk premiums may be inaccurate. As a result, the premium rates set by NFIP may not fully reflect the risk of loss due to flooding.

Data Used to Determine Flood Probabilities Have Not Been Updated since the 1970s and 1980s

FEMA's estimates of probabilities that floods of different severities (relative to the BFE) will occur in a given year, or "probability of elevation" (PELV) values, were generated in the 1970s. Within any zone, the risk that floodwaters will reach the BFE in any year is 1 percent, but across zones the likelihood that floodwaters will reach a foot above or below that level varies. PELV tables provide detailed information, by zone, about the frequency with which floods of different elevations are expected to occur. These data were generated using detailed engineering studies, available flood data, simulations, and professional judgment and were established for each flood zone to meet generally accepted scientific parameters and legal considerations of the time. FEMA later concluded that flood probabilities were likely underestimated in some cases because of the short flood histories used in some of the studies. As a result, according to FEMA officials, some of the original PELV values were modified in the early 1980s to account for this statistical bias. They have not been revisited or updated since that time.

[24]Highly variable events (events with losses varying widely from year to year) and greatly skewed events (very rare but very large catastrophic events) such as floods, hurricanes, and earthquakes do not lend themselves to traditional actuarial pricing techniques. Results can vary dramatically from year to year and average results have little predictive value even when gathered over a long period of time, thus rendering the use of historical flood loss experience for setting rates problematic.

FEMA currently uses both the original and modified PELV values in the rate-setting process. The original PELV values contribute 80 percent to the ultimate results and the modified values 20 percent, reflecting weights set out by policies from the early 1980s, according to FEMA officials. Flood risk experts have suggested that flood probabilities (and thus flood insurance rates) are likely to change as land use (such as urban or suburban development), infrastructure (such as new bridges and culverts), and weather patterns change. FEMA could capture such changes by updating its flood probability data but has not done so.

FEMA officials also acknowledged that the weighting for the original and modified PELV values was likely out of date but said that other competing priorities, including supporting post-Katrina-related activities and other studies had been given priority.[25] Moreover, a FEMA official noted that the weighting might introduce a degree of "conservatism" to the rate-setting process because it would lead to higher rather than lower premium rates.[26] Further, according to the officials, the geographic mix of NFIP policies had become more concentrated in Florida and other communities where the PELV values were more accurate. Nevertheless, FEMA has not updated the PELV data since the 1980s or updated the weighting of the original and modified PELV data. As a result, the accuracy of the flood probability estimates and the probability of elevation values are uncertain, and we could not determine whether the rates based on such data were accurate. Moreover, FEMA was not able to provide any analysis that it had done to determine that the current weighting remained appropriate or that the probabilities had not changed in over 30 years.

The Claims Data Used in the Model May Be Inaccurate

In addition, some claims data—which are updated on a periodic basis—may suffer from errors and thus misinform damage estimates and, in turn, the rates generated by the model. FEMA relies on estimates of the percentage of the value of a structure that is expected to be damaged

[25]Studies include those by CRS, CBO, GAO, and the DHS Office of Inspector General.

[26]A FEMA official explained to us that by not updating the PELV data, NFIP essentially was assuming that the difference between the 10 percent annual chance of flood (that is, the 10-year flood) and the 1 percent annual chance of flood has not changed since the data were published in the 1970s and 1980s. FEMA told us that the PELV data have been used in such a way as to make the rates less sensitive to factors such as changes in land use, structural development, or climate trends. FEMA also noted that actuarial judgments during rate setting deal with a variety of uncertainties, such as those that go beyond simply relying on the calculation based on the hydrologic model. According to FEMA, other efforts, such as contingency loading or across-the-board rate increases on a zone, and improved floodplain management, have been made to compensate for the impact of these factors.

when a flood occurs, or the "damage by elevation" (DELV) values. DELV information is measured in 1-foot increments of the flood level within the structure and is expressed as the expected percentage of the property's value that will be damaged by a flood of that elevation.[27] As with the PELV data, information used in establishing DELV values was obtained primarily from engineering studies. In 1973, data for DELVs were selected on the basis of studies done by the Corps and available flood claims at that time. Currently, FEMA modifies the Army Corps DELV values based on its NFIP claims experience. When FEMA determines that its own loss data are "credible," it uses these data rather than the original data generated by the Corps.[28] However, FEMA also currently uses updated Corps damage data to supplement NFIP claims data where it lacks sufficient credible loss data. According to a FEMA official, for the most common type of property insured by NFIP, the claims process has become fully credible for a wide range of water depths in the structure.

However, evidence suggests that there are inaccuracies in the actual claims data used to update the DELV values. An external study noted some internal control problems with NFIP's claims database.[29] For instance, claims records were often incomplete because the claims data had been collected in the field by local adjustors for purposes of processing claims. As a result, many records did not indicate BFE or depth of flooding, clearly differentiate between wind and water losses, or capture losses above the insurance limit when damage exceeded coverage limits. In addition, Corps officials told us that they had reviewed FEMA's claims between 1998 and 2000 databases and found the data to be unreliable for their purposes. For example, according to the Corps, in some cases the claims data indicated flood damage, but flood height data were missing. FEMA's database recorded these missing height data as a flood height of zero. Our analysis of NFIP claims paid between 1978 and 2007 further

[27]For DELV estimates, if water reached a depth of 2 feet relative to the BFE within a one-story, no-basement structure located in the high-risk zone, 25 percent of the property's value would be damaged; however, if water reached a depth of 4 feet within the same structure, 30 percent of the property's value would be damaged.

[28]"Credible" refers to the degree of belief that the entity's prior experience is a valid predictor of future costs.

[29]American Institutes for Research, *Assessing the Adequacy of the National Flood Insurance Program's 1 Percent Flood Standard*, American Institutes for Research, prepared under subcontract to the American Institutes for Research as part of the 2001-2006 Evaluation of the National Flood Insurance Program, Water Policy Collaborative, (College Park, Md.: University of Maryland, October 2006).

supports what the Corps told us. We found an increasing percentage of claims with "0" water depth until they leveled off at between 44 and 49 percent from 1998 until 2004. In 2005 when the Gulf Coast hurricanes occurred, this percentage dropped to about 13 percent, but has risen above 22 percent in the more recent years. Thus, an erroneous data combination of positive flood damage and zero flood height was being used to develop damage curves. As a result, the Corps began to collect its own damage data, which FEMA now uses to supplement its own data.

While FEMA has acknowledged that some problems exist, it believes that these types of errors relate primarily to the most severe flooding events, which have a lower probability of occurring, involve greater water depths, and would contribute only marginally to insurance rates. FEMA officials said that they had reviewed the possible impact of such data errors and did not consider them to be significant because they believed that the zero-elevation water depth errors would overstate the amount of damage from zero amount of water in a property.[30] However, this analysis is incomplete because it does not evaluate the impact of omitting these damage amounts from the actual flood depth levels. As a result, FEMA may be unable to fully assess the overall impact of these errors or omissions on its full-risk rates, creating a risk that these premiums may not accurately reflect the actual risk of flood loss.

Maps That Provide Information for Base Flood Elevations Remain Substantially Out of Date despite Modernization Efforts

FIRMs provide the information that determines BFEs, a key input in the rate-setting model. FEMA formally undertook map modernization efforts in fiscal year 2003. According to FEMA, the agency undertook map modernization for several reasons:

- Flood hazard conditions are dynamic, and many NFIP maps may not reflect recent development and/or natural changes in the environment.
- Updated NFIP maps can take advantage of revised data and improved technologies for identifying flood hazards.
- Up-to-date maps support a flood insurance program that is more closely aligned with actual risk, encourages wise community-based floodplain management, and improves citizens' flood hazard awareness.

[30]According to FEMA officials, zero elevation water is a depth that encompasses up to the first 5 inches of floodwater in a property. This depth is also sometimes referred to as a "carpet soaker" flood.

- Local communities and various stakeholders want more timely updates of flood maps and easier access to the flood hazard data used to create the maps.

  In 2005, FEMA adjusted its goals and currently expects to provide updated flood boundaries for 75 percent of stream miles reflected on FEMA's issued maps and 0.30 percent of those mapped stream miles will be based on new or updated engineering studies by the end of the program in 2010. FEMA also revised its goal of having digitized maps that covered 100 percent of the population to having digitized maps for 92 percent of the population so that it could better focus its efforts and thus improve map quality. FEMA undertook these changes in response to concerns expressed by Congress and DHS's Inspector General's office and in response to our prior work on this issue.[31] FEMA officials stated that changes in land use and structural development that had occurred over time would be captured when FEMA updated the FIRMs, each of which is required to be reassessed every 5 years.[32]

  According to FEMA, as of May 2008, approximately 4 percent of U.S. counties had maps that accurately reflect the current risk of flooding (fully updated) and were newly digitized and 2 percent had old maps that may or may not accurately reflect the actual risk of flooding but were newly digitized. For the remaining 94 percent of U.S. counties, the maps were a combination of new and old mapping data that were in production or have not yet begun the process. According to FEMA officials, although maps for 94 percent of U.S. counties had not been fully updated or newly digitized, all counties had received a partial update to their flood hazard information and more than a third had received updates that exceeded one of FEMA's

[31]See GAO, *Flood Map Modernization: Program Strategy Shows Promise, but Challenges Remain*, GAO-04-417 (Washington, D.C.: Mar. 31, 2004).

[32]FEMA has produced FIRMs that depict SFHAs for approximately 20,000 communities nationwide. The SFHA represents the flood that has a 1 percent annual chance of occurring in any given year, sometimes referred to as the "base flood." The base flood is the national standard used by NFIP and all federal agencies for the purposes of regulating development and requiring the purchase of flood insurance. Reliance on the 100-year flood as an adequate standard was brought into question in a recent report. See American Institutes for Research, *Assessing the Adequacy of the National Flood Insurance Program's 1 Percent Flood Standard*.

national map quality targets.[33] FEMA further stated that in March 2008, approximately 68 percent of the nation's population had received a map that met, exceeded or at least approached map quality targets of map modernization. An additional 27 percent of the population has received a preliminary map. FEMA informed us that it anticipates that 92 percent of the nation's population will have a modernized map by 2010.

However, although FEMA has been working to update FIRMs and improve their quality, a significant portion of the maps reflect data at least 15 years old, which may or may not accurately reflect actual risk of flooding. As of April 2008, 50 percent of the nation's approximately 105,700 flood maps were at least 15 years old, 58 percent were more than 10 years old, and 70 percent were at least 5 years old. To the extent that these older maps are inaccurate and the risk of flooding has changed, reliance on these older maps could lead to inaccurate flood risk assessments, which in turn could lead to inaccurate premium rates.

FEMA Does Not Track the Number or Location of Remapped Grandfathered Properties That Pay Less than Full-Risk Premiums

FEMA made a policy decision to grandfather into the program certain properties, that is, it allowed properties that have been remapped into riskier flood zones to keep their previous lower rates. FEMA is in the process of updating FIRMs through its Map Modernization program, but these new maps may not lead to more accurate pricing due to this policy decision, which was based primarily on concerns about the affordability of the resulting rates.[34] FEMA documents state that properties are grandfathered in order to recognize policyholders who have complied with their original FIRM, have remained loyal NFIP customers, or both. In general, two categories of buildings may be grandfathered into the program: (1) those built in compliance with the FIRM that was in effect at

[33]FEMA has established national map quality targets under Map Modernization by tracking compliance with the Floodplain Boundary Standard and the new, validated, or updated Engineering metric. Compliance with the boundary standard indicates that the mapped floodplain matches the underlying topographic information. Compliance with the engineering metric indicates that engineering analyses used to determine the extent of the flood hazard have been either newly established or updated. The national map quality targets under Map Modernization are 75 percent of mapped stream miles compliant with boundary standard and 30 percent of mapped stream miles compliant with the engineering metric.

[34]According to FEMA, an important reason for making the grandfathering decision was that policyholders who were in compliance with their existing FIRMs should not be required to pay higher prices for new conditions of which they were previously unaware.

the time of construction and (2) those built before a FIRM was in effect or that were not in compliance at the time of construction.[35] For those buildings in compliance at the time of construction, property owners need to provide documentation of the date of the original FIRM and the property's flood zone, BFE, and other map-related information. Properties that were not in compliance generally can be grandfathered if they have had continuous flood insurance and if the building has not been altered in certain ways. FEMA officials told us that while grandfathering can work as a disincentive for sound floodplain management, the decision to grandfather rates was based on consideration of (1) equity, (2) ease of administration, and (3) goals of promoting flood plain management.[36]

While FEMA does not consider the premiums on these properties to be subsidized because they are based on the average risk for the whole class to which they had been assigned previously, they share two characteristics with subsidized rates. First, rates based on new FIRMs should more accurately reflect flood risk, but grandfathered properties will not be charged those rates. Second, the grandfathered status of a property continues indefinitely, even when the property is sold. FEMA officials acknowledged that property owners that obtain grandfathered rates for their homes are being cross-subsidized by other policyholders in the same zone that are paying higher rates.[37] For example, under grandfathering, repetitive loss properties remapped into a higher-risk zone instead would pay a rate generally charged to lower-risk properties.

[35]These are pre-FIRM properties that were built before detailed flood hazard data and flood elevations were provided to the community and usually before the community enacted comprehensive regulations on floodplain regulation.

[36]FEMA officials stated that grandfathering presented a disincentive for sound floodplain management because grandfathered owners would be unaware of the true risk of flooding to their properties and would therefore be less likely to mitigate. But the officials also stated that in making this decision they took into consideration several concerns: (1) potentially higher rates that could cause property owners not to buy insurance or to lose their properties, (2) adverse reactions to FEMA as the result of these higher rates, (3) the burden on insurance agents of obtaining new map determinations and information for every policyholder, and (4) the likelihood of communities resisting new maps due to the potential for large rate increases.

[37]In most property and casualty insurance lines, state assessments are often passed through to policyholders. As a result, policyholders living in less risky locations also contribute to cover the shortfall—a scenario known as cross-subsidization. In those states where assessments cannot be passed through in some manner, private insurers must pay the assessments while at the same time paying large claims from their own policyholders. In such instances, some companies may be reluctant to continue offering coverage in the state or may become insolvent.

While grandfathered rates are used to keep existing policyholders, FEMA has not taken steps to measure the impact of these rates on the program's financial condition. FEMA officials said that they currently had limited data on new or existing grandfathered properties and are just beginning to explore ways to track these properties. For example, they had not tracked the number of grandfathered properties or calculated how much lower grandfathered premiums are than the actual rates. As a result, they did not know the effect of grandfathered properties on the program's total premium collection and the extent to which these rates deviate from fully risk-based rates. Without this information, FEMA's ability to address the financial impact of such properties on NFIP's financial health is limited. FEMA officials acknowledged the importance of tracking information related to grandfathered properties and told us they plan to start a tracking process in May 2009.[38] However, they said that this process will not capture the inventory of existing grandfathered properties.

FEMA Does Not Consider Risk Factors Such as Erosion and Climate Change when Setting Flood Insurance Rates

Some experts with whom we spoke have suggested that incorporating ongoing and planned development, erosion trends, and climate change into flood risk modeling would more fully capture longer-term flood risk exposure, but FEMA does not take these variables into account. FEMA's present policy is to map SFHAs based on current development conditions. However, as floodplains are developed and more ground surfaces are paved or made impervious (nonabsorbent), the risks and expected elevations of flooding increase. As the predicted elevation of the base flood increases, SFHAs subsequently spread beyond mapped boundaries. As a result, in rapidly developing watersheds or where characteristics change significantly due to flood control projects or other natural events, some FIRMs may become outdated shortly after their completion. In addition, some properties could be constructed without proper protection from the flood hazard they may face throughout their life span, and others could be uninsured or subject to insurance rates that do not accurately reflect flood risk.

[38]The two types of policies in the moderate- to low-risk zones are referred to as preferred risk policies and the standard policy. The preferred risk policyholders generally pay the lowest flood rates. Preferred risk policies are available on buildings that are outside of the SFHA and have not flooded more than once.

FEMA's current flood hazard mapping procedures for coastal areas incorporate storm-induced coastal erosion but not long-term erosion.[39] While shorelines, dunes, and bluffs can retreat during a single storm, long-term erosion at a shoreline is the net result of a variety of factors such as sediment losses from storms and inundation from sea level rise, averaged over several decades.[40] A 2000 study conducted for FEMA by the H. John Heinz Center estimated that over the next 60 years, losses due to the effects of coastal erosion would average $80 million annually.[41] If coastal development continues at its current pace, or if sea levels rise as some scientists have predicted, such losses could be even greater. In the absence of the authority needed to establish erosion zones, FEMA has taken action based on the results of the study, namely, a steady annual increase in rates for the high-risk coastal zone at a pace it says is commensurate with the study's projections.[42] In addition, according to FEMA officials, they formed an internal working group to determine additional actions that could be taken to implement the report's recommendations under the existing laws and regulations that govern NFIP. The working group concluded that because of the statutory limitations, implementing the recommendations would require direct congressional authorization.[43] Therefore, FEMA, which does not currently map erosion hazard areas, is unable, through its rate-setting process, to inform policyholders of the risk to their property from erosion. Consequently, in some cases flood insurance rates may send a false signal

[39]Coastal erosion is long-term erosion such that a shoreline retreats at or around an average rate over a period of decades.

[40]Shorelines rarely recede at a constant rate; instead, erosion occurs in a cyclic fashion, with seasonal and episodic influences resulting in periods of erosion, periods of stability, and periods of accretion. On shorelines suffering from long-term erosion, the periods of erosion outweigh or overwhelm the periods of stability and accretion.

[41]The H. John Heinz III Center for Science, Economics and the Environment, *Evaluation of Erosion Hazards*, Prepared for the Federal Emergency Management Agency Contract EMW-97-CO-0375, (Washington D.C.: April 2000).

[42]The National Flood Insurance Act of 1968, as amended, authorizes FEMA to carry out NFIP to enable persons to buy insurance against losses arising from flood. The statute defines flood as including sudden, flood-event-triggered collapses or subsidences of land along the shore of a body of water, but the statute's definition of flood does not include the gradual, long-term erosion that may endanger coastal communities. See 42 USC 4001, 4002 and 42 USC 4121(c).

[43]FEMA officials told us that they could likely map erosion hazard areas on FIRMs for informational, but not rate-setting, purposes under its existing authority. However, FEMA estimates the total cost of this effort could range between $50 million and $100 million.

that understates the risk exposure faced by current policyholders or prospective development.

FEMA also does not incorporate the potential effects of climate change into its rate-setting considerations. Our 2007 report on climate change discussed the effects of climate change on weather-related events and, subsequently, insured and uninsured losses. We found that leading scientific bodies expect warmer temperatures to increase the frequency and severity of damaging extreme weather-related events.[44] In addition, population growth in hazard-prone areas and the resulting development and increasing real estate values have increased the exposure of federal and private insurers. In particular, heavily populated areas along the Northeast, Southeast, and Texas coasts, which are at the highest risk for major hurricanes, also have some of the highest value properties in the United States. Because of these and other factors, our report estimates that NFIP's exposure has grown substantially, quadrupling since 1980 and nearing $1 trillion.

While many private insurers are beginning to take climate change into account, FEMA has done little to develop the kind of information needed to understand the long-term exposure of NFIP to climate change for a variety of reasons. For instance, NFIP's goals are fundamentally different from those of private insurers. Specifically, private insurers stress the financial success of their business operations, but the law authorizing the federal flood insurance program promotes affordable coverage and broad participation by individuals at risk. In addition, although FEMA manages its risk within statutory guidelines, unlike private insurers, NFIP is neither required nor permitted to limit its catastrophic risk strictly within its ability to pay claims on an annual basis. One important implication of this lack of limits on managing catastrophic risk is that FEMA has little reason to develop information on NFIP's long-term exposure to the potential risk of increased low-frequency, high-severity weather events associated with climate change. NFIP's risk management processes adapt to near-term changes in weather as they affect existing data. As a result, NFIP is designed to assess and insure against current—not future—risks and currently does not have the information necessary to adjust rates for the potential impacts of events associated with climate.[45] FEMA told us that it

[44]GAO, *Climate Change: Financial Risks to Federal and Private Insurers in Coming Decades Are Potentially Significant*, GAO-07-285 (Washington, D.C.: Mar. 16, 2007).

[45]This is consistent with standard actuarial practice for pricing 1-year term insurance.

has commissioned a study to assess the long-term exposure to climate change that will investigate changes in sea levels, intensity and frequency of hurricanes, and precipitation patterns.

FEMA's Rating System Combines and Averages Many Different Risks to Create Nationwide Rates

FEMA classifies properties according to flood risk using a single, nationwide class-rating system rather than an individual property or community-by-community rating system. That is, all properties grouped into a class—based on structure type and elevation relative to the BFE—are assumed to have the same risk.[46] Further, FEMA charges the same rate for a given class in the high-risk zone (or separately, in the high-risk coastal zone) regardless of location within the zone. Thus, two properties in the same class but located on vastly different terrain—for example, one in a shallow floodplain and the other in a steep and narrow mountain valley—are charged the same rate per $100 of insurance coverage despite the fact that they may have different expected loss.

The NFIP model can incorporate specific topographic (that is, flood zone) information in rate setting. However, according to FEMA, it was determined that more averaging could be justified, because the differences in rates across flood zones were not significant enough to warrant that level of detail. According to FEMA officials, the class-rating approach balanced the need to recognize significant differences in risk with a simplified process for determining rates that was easier for the sales force and others to use. FEMA has not revisited its class-rating approach since its inception although certain program elements have changed since that time. For example, program participation has more than doubled from just over 2 million policies to more than 5.2 million from the late 1980s to 2007 and increased numbers of properties have been constructed on SFHAs. As a result of the growth in the program, the rate classes may not accurately reflect the actual flood risk to individual properties and averaging may no longer accurately reflect differences in rates within zones.

[46]NFIP implemented the nationwide class-rating system because of the nature of the program and the desire to make it less complex and easier for agents and customers to understand. In the early years of the program, rates were set on a community-by-community basis. But as the number of communities participating grew, this system became unwieldy and costly to maintain. FEMA analysis indicated that from a technical perspective, this system was not essential to the estimation of flood damages since, for example, flood frequency data were found to be similar across communities.

Our Analysis of Historical Claims and Premium Data Raises Questions about a Potential Mismatch between Rates and Risk

We analyzed 30 years of NFIP data on claims and premiums and found patterns based on differences among states indicating that NFIP rates may not have always accurately reflected differences in flood risk.[47] As we have seen, FEMA sets premium rates that apply nationwide. Our state-by-state analysis of annual claims and premiums data dating back to 1978 showed that some states consistently had more years in which claims exceeded premiums than did other states over this period, raising questions about a potential mismatch between rates and risk.[48] It is important to note that claims equaling premiums in a given year would not indicate a break-even year, because in addition to covering expected claims in a year, a portion of premiums is also intended to cover expenses necessary to operate NFIP. For example, in the year ending May 1, 2008, NFIP projects about 53 percent of its total expenses would pay for claims, while the rest would cover other expenses such as interest on debt, loss adjustment expense, and agents' commissions. For the purposes of this report, we assigned the title of high-loss year to any year in which a state's claims exceeded its premiums, because in these years, these states would not have had any premium dollars left over to contribute toward administrative expenses once claims had been paid.

On an annual basis, we found that for 1978-2007, nine states had high-loss years more often than once every 4 years (table 3). Missouri and West Virginia had the most high-loss years, with 11; Alabama, Illinois, Louisiana, Mississippi, New Hampshire, Ohio, and Texas followed, with from 8 to 10 such years. Other states had very few high-loss years, and some had none. For example, Alaska, Colorado, and New Mexico had no high-loss years, while Florida, Idaho, Oregon, South Carolina, and Vermont had 1, and Nevada, Utah, and Wyoming had 2.[49] The consistency with which some states were at one extreme of the high-loss-year distribution or the other since the late 1970s suggests that NFIP's method of setting flood insurance rates on a nationwide basis may not accurately reflect differences in flood risk among states, because rates for similar properties do not vary by state.

[47]We computed the difference between the dollar amount of losses on claims paid out in that state by NFIP and the dollar amount of premiums collected in that state by NFIP.

[48]Because of the data limitations, our analysis was performed using claims and premiums data from both full-risk and explicitly subsidized policies.

[49]See appendix II for a full listing of states.

Table 3: States Where Claims Frequently or Rarely Exceeded Premiums, 1978–2007

In constant 2007 dollars			
State	**1978-2004 premiums minus claims**	**1978-2007 premiums minus claims**	**1978-2007 Number of years that claims exceeded premiums**
Missouri	($384,344,855)	($350,344,220)	11
West Virginia	(146,896,812)	(118,874,830)	11
Mississippi	(40,584,822)	(2,498,544,520)	10
Louisiana	428,383,041	(11,777,260,456)	10
Texas	(728,796,632)	(222,265,084)	9
Alabama	(505,212,107)	(746,166,995)	9
Illinois	90,321,291	162,050,972	9
Ohio	101,547,985	100,111,514	9
New Hampshire	36,648,547	21,531,170	8
Utah	15,372,336	21,207,776	2
Wyoming	16,597,320	21,134,460	2
Nevada	70,283,808	82,293,838	2
Vermont	23,425,436	30,590,342	1
Idaho	32,991,914	42,892,136	1
Oregon	104,014,018	133,186,375	1
South Carolina	313,400,772	590,371,633	1
Florida	8,035,673,802	9,938,638,592	1
Alaska	23,003,446	27,770,628	0
New Mexico	79,909,374	97,876,034	0
Colorado	$135,763,975	$170,139,136	0

Source: GAO analysis of FEMA data.

Note: We analyzed two time periods so we could separately consider the impact of the 2005 Hurricanes Katrina, Rita, and Wilma. The numbers in parenthesis denote negative values

We recognize that flooding is a highly variable event, with losses varying widely from year to year, and that even an analysis of nearly three decades of historical data could lead to unreliable conclusions about the actual flood risk faced by a given state. In addition, we note that Florida, Texas, and Louisiana are among the states with the most NFIP policies, and therefore have a more significant impact on the amount of premiums collected than other states. Some discrepancies in high-loss years among states are to be expected and do not necessarily indicate that NFIP premium rates are mispriced. However, if some states frequently have high-loss years or rarely or never have such years, questions arise about

the rate structure, because policyholders in states with frequent high-loss years are paying the same rates as policyholders with similar properties in states with fewer losses.

Additional study would be required to determine whether policyholders in some states with lower losses are paying a higher premium than is appropriate for their risk, and others paying too little. For example, our analysis did not control for differences in the type of policy purchased, such as the mix of certain property types across states and insurance coverage amounts, which could affect both premiums and claims. In addition, we did not control for differences in the mix of subsidized and full-risk policies or the impact of subsidized premiums on our results, which could also affect the results.[50] Despite these limitations, however, this analysis raises a number of questions that may warrant further study that could provide useful insights into the use of nationwide rates as well as other aspects of the program.

Collectively, these factors raise questions about FEMA's rate-setting process and increase the risk that NFIP full-risk premiums rates may not accurately reflect the underlying risk of flood loss. As a result, the premiums collected by FEMA for full-risk policies may not be sufficient to cover the risks associated with those policies. If the premiums are not sufficient, FEMA will likely have to continue to borrow from the Treasury and could face a future of financial instability because of its ongoing inability to cover claims and expenses.

[50]Some states have a relatively large number or proportion of subsidized properties (including grandfathered properties) that generally would lead to higher expected claims relative to premiums, but we were unable to link the separate NFIP claims and premiums data at the state and zone levels in a way that would allow us to perform a more refined analysis. The limitations in setting full-risk rates that we have discussed could result in systematic mispricing relative to risk that becomes apparent only over long periods; however, our analysis included both subsidized and full risk properties, and so the results should be considered in this context.

FEMA's Process for Setting Subsidized Rates May Further Compromise the Ongoing Financial Stability of the Program

FEMA's rate-setting process for subsidized properties, which depends in part on the accuracy of the full-risk rates, has evolved over time. Currently, to determine subsidized rates, FEMA first subtracts the total amount that it expects to collect on full-risk rate premiums from the average historical loss year target—the minimum amount of premiums the program needs to collect to cover at least average annual losses based on historical loss data. The amount remaining from this calculation is the aggregate target amount of subsidized premiums that the program needs to collect. Then to set individual subsidized rates, FEMA officials consider their knowledge of flood risks, previous rate increases for various areas, and statutory limits on rate increases. Currently, the annual amount that NFIP collects in both full-risk and subsidized premiums is not enough to cover its operating costs, claim losses, and principal and interest payments to the Department of the Treasury. Without changes to its current rate-setting processes, NFIP premiums will be unlikely to be able to cover the program's claims, expenses, and debt, exposing the federal government and ultimately taxpayers to ever-greater financial risks, especially in years of catastrophic flooding.

The Process Used to Set Subsidized Rates Has Evolved over Time

In designing NFIP, Congress required that premiums for certain properties be offered at prices below those for full-risk premiums to encourage participation in the program and to ensure that premiums were affordable for existing structures in the floodplain. However, the statute does not provide a formula or methodology for setting the subsidies, leaving it up to the program to develop one. When the program began, NFIP administrators set the subsidized rates on the basis of what they believed would be affordable, but this process resulted in losses that had to be covered by borrowings as discussed previously. Some of the resulting deficit was later forgiven by Congress.

In 1981, NFIP administrators, after discussions with Congress, started setting NFIP's subsidized premium rates based on the average historical loss year calculations.[51] According to FEMA, this change allowed the agency to resist external pressures in setting premium rates and provided a more objective standard for determining subsidized rates. FEMA documents from most years between 2001 and 2006 state that the average historical loss year target, which is based on losses from previous years

[51]The average historical loss is calculated by adjusting the loss payouts of prior years to account for inflation and increases in the number of NFIP policies.

averaged over time, generally is considered a floor for premium collection. To account for the potential of catastrophic losses, and the additional funds required to pay such losses, FEMA sets premium rates so that the total premiums collected will be approximately 15 to 25 percent greater than the average historical loss year estimate.

However, FEMA can adjust, and has recently adjusted, the way it calculates the average historical loss year. Although loss years can vary markedly, none of those taken into account before 2005 included the kinds of catastrophic losses seen after Katrina, Rita, and Wilma. According to FEMA officials, including the 2005 losses in calculations of the average historical loss year would have resulted in premium increases well above the 10 percent statutory limit.[52] As a result, FEMA officials instituted a weighting factor for the 2005 losses, and as a result the full amount of the losses was not incorporated into the rate-setting model. According to FEMA officials, they incorporated losses of $2.1 billion of the estimated $23.2 billion in losses from 2005.[53] NFIP set the 2007 and 2008 flood insurance rates based on this modified methodology.

Although FEMA has incorporated more objective criteria against which to set rates for subsidized premiums, the process also depends on the accuracy of calculations for full-risk premiums.[54] After FEMA derives the full-risk premiums, it deducts the total amount of full-risk premiums that it expects to collect from the average historical loss year target; the remainder is the amount in premiums that it needs to collect from subsidized policies. Subsidized rates are then set based on this amount. Thus, the level of subsidized rates charged to policyholders depends, in part, on the full-risk premiums determined by FEMA. For example, if full-risk premiums are too low because they do not accurately reflect flood risk, the total amount FEMA will need to collect from subsidized policies will be higher, resulting in higher subsidized premiums.

[52]By statute, rates may not be increased by an amount that would result in the average of such rate increases for properties within the risk classification during any 12-month period exceeding 10 percent of the average of the risk premium rates for properties within the zone.

[53]FEMA officials told us that through various calculations, they updated the $17.4 billion in losses from Katrina in 2006 to $23.2 billion presently. These calculations included an increase of 20 percent in NFIP policies and an increase of 10 percent for inflation.

[54]According to FEMA, this process was established jointly by Congress and FEMA.

Finally, according to FEMA, the rate-setting process for subsidized premiums also involves other considerations. Officials said once they had calculated the aggregate amount of subsidized premiums they would need, they determined the subsidized rate increases and ultimately the rates for the individual zones based on their knowledge and understanding of flood risks. FEMA officials told us that their decisions on how much to raise rates on various zones took into account concerns about the effect of increases on policyholders, the level and extent of past rate increases, and knowledge of relative flood risks in those areas. FEMA did not provide us with any written documentation describing how these decisions were reached. As mentioned previously, by law FEMA can raise rates on each zone by no more than 10 percent a year. Our review of FEMA documents show that FEMA raised rates significantly for a small number of policies and by very little for a large number of policies from 2002 through 2006. For example, FEMA raised rates by an average of more than 9 percent on about 1 percent of all NFIP policies—specifically, on certain subsidized policies located in high-risk coastal zones. In contrast, FEMA raised rates by an average of around 2 percent on 40 percent of total policies in high-risk zones that were paying full-risk rates. Ultimately, the generally small increases will not help ensure NFIP's financial stability and may in fact decrease it by adding to its operating deficit.

NFIP's Current Rate-Setting Processes Result in Premiums That Are Not Sufficient to Cover Current Debt and Future Claims

The processes and policies that FEMA uses to set both full-risk and subsidized premium rates have contributed to NFIP's inability to generate enough in premiums to cover the program's operating costs, claims losses, and debt to the Treasury. From 1978 through 2004, NFIP had a net loss of $2 billion. These years had historically low flooding, but NFIP had yearly deficits for about half of these years. Over that period, Congress retired about $1.2 billion of this total debt. However, the introduction of average historical loss year targets in the 1980s resulted in a series of rate increases that contributed to a sizeable reduction of the net loss.

The 2005 hurricanes significantly altered NFIP's financial landscape. The 2005 hurricanes, especially Katrina, left the program with debt of more than $17.4 billion as of June 2008. To service the debt to the Treasury, FEMA owes two annual interest payments of around $365 million that are generally due in April and October of each year. FEMA officials told us that they were able to make the two payments in 2007 without borrowing because, according to FEMA documents, NFIP faced unusually light flooding in 2006 and 2007. In addition, FEMA made an unscheduled principal payment of $225 million in November 2007. However, in April 2008, FEMA borrowed $50 million to pay the $364 million interest payment

owed to the Treasury. FEMA estimates that it will owe a total of $734 million in interest charges in fiscal year 2008.

FEMA officials informed us that they did not know whether NFIP would be able to make future interest payments without borrowing because of uncertainty about future flooding. According to FEMA documents, FEMA has paid $1.6 billion in interest to the Treasury since 2005. NFIP currently has about 5.6 million policies in force, resulting in approximately $2.6 billion in total premium. Historically, program expenses (excluding loss and allocated loss adjustment expenses) have averaged around 38 percent of premiums, or $1 billion of current total premium collection. As of June 2008, NFIP's average noncatastrophic historical loss year (which excludes Hurricanes Katrina, Rita, and Wilma) is about $1.3 billion. The combined outlays for loss and loss adjustment expenses of around $1.3 billion, administrative expenses of approximately $1 billion, and interest payments of approximately $0.7 billion exceed the program's current premium collection of approximately $2.6 billion. Under current conditions, it is unlikely that NFIP will be able to meet its interest payments in most years, and the program's debt will likely grow as the program borrows to meet the interest payments.

Conclusions

Over the years, FEMA has taken a number of steps to improve the rate-setting process, which was established more than two decades ago, but a number of factors raise questions about whether the resulting rates reflect the actual flood risk. First, potentially outdated and inaccurate data about flood probabilities, damage claims, and flood maps are increasing the risk that full-risk premiums do not reflect actual risk of flooding. Second, unlike many insurers in the private sector, FEMA has done little to understand the long-term impact of planned and ongoing development on damage estimates. While this is due, in part, to the fact that FEMA lacks the authority to factor potential or long-term development into potential flood damage, FEMA has not, for example, evaluated how such developments could affect the accuracy of its maps. Finally, FEMA's continued use of a nationwide rating structure that combines zones across geographic areas despite the substantial growth of the program introduces additional uncertainties. While additional analysis of the data is needed, our analysis found that some patterns in historical claims and premiums collected raise questions about whether this approach is still appropriate and reasonable given the growth in the program. Collectively, these factors call into question the accuracy of the full-risk rates generated by FEMA's rate model. By updating elements of its flood rate model and certain rate-setting policies, FEMA could help ensure that data used in its

model such as flood probabilities, damage estimates, and information from flood maps are as accurate as possible. In addition, by reconsidering risk aggregation across flood zones and the effects of development and climate change into the rate-setting process, FEMA has the opportunity to make its model more robust and increase the accuracy of its rates.

Similarly, FEMA's policy of allowing properties that have been remapped to higher-risk zones to retain lower rates results in rates that do not accurately reflect flood risk. Because the premiums are not based on the actual risk of flooding, these policyholders are receiving a subsidy from other policyholders in the same zone and the federal government—and ultimately from taxpayers. We are encouraged that FEMA plans to implement a monitoring process for grandfathered properties, which would allow it to better determine the impact of these properties on the program's financial stability. However, because FEMA plans to track only grandfathered properties in the future, not existing properties, it will not be able to fully evaluate whether grandfathering actually is fulfilling the desired goals in a cost-effective way. Unless there is a full accounting of grandfathered properties, these properties expose the program to an unknown level of risk. Prompt attention to this issue could allow NFIP to refine its rate-setting process in the short term and provide valuable information on the effects of its policy decision on the financial stability of the program.

Finally, FEMA's rate-setting process for subsidized properties depends in part on the accuracy of full-risk rates, raising concerns about how these rates are calculated as well. While FEMA is statutorily required to subsidize rates, the method used for setting subsidized rates has evolved from one that is based largely on affordability to one based on the average historical loss year estimate. The resulting subsidized premiums continue to be a financial strain on NFIP and contribute to its ongoing financial instability. Based on NFIP's current premium collections, it is not only unlikely that NFIP will be unable to repay its debt but also unlikely that it will be able to make interest payments in years with any significant amount of flood activities, and the program's debt will likely grow as it borrows to meet the interest payments, as was the case in mid-2008. Unless NFIP addresses issues with its rate-setting processes, premiums collected will remain insufficient in the face of future flood losses—even in average flood loss years—leaving both the program and taxpayers at increased financial risk. While a robust rate-setting process that accurately reflects underlying flood risk is a key step in helping to improve the long-term financial stability of NFIP, no process can ensure that premiums will always cover losses because of the potential for large claim losses

associated with catastrophic events. However, any efforts to improve the accuracy of the premiums charged by the program will help reduce the financial risk to which the federal government and, ultimately, taxpayers are exposed from the flood insurance program.

Recommendations for Executive Action

We recommend that the Secretary of the Department of Homeland Security direct FEMA to take steps to ensure that its rate-setting methods and the data it uses to set rates result in full-risk premiums rates that accurately reflect the risk of losses from flooding. These steps should include, for example, verifying the accuracy of flood probabilities, damage estimates, and flood maps; ensuring that the effects of long-term planned and ongoing development, as well as climate change, are reflected in the flood probabilities used; and reevaluating the practice of aggregating risks across zones.

We also recommend that the Secretary of the Department of Homeland Security direct FEMA to ensure that information is collected on the location, number, and losses associated with existing and newly created grandfathered properties in NFIP and to analyze the financial impact of these properties on the flood insurance program.

Agency Comments and Our Evaluation

We provided the Secretary of Homeland Security with a draft of this report for review and comment. On October 14, 2008, FEMA provided written comments on a draft of this report. FEMA generally concurred with both of the report's recommendations but had two reservations about our recommendation to ensure that FEMA's rate-setting methods result in full-risk rates that accurately reflect the risk of losses from flooding. Moreover, while FEMA noted that the report makes a number of constructive suggestions, it took exception to some of our analyses and characterizations, which it believes overstate their potential impact on the accuracy of the rate-setting process. These comments are summarized below and FEMA's letter is reprinted in appendix III. FEMA also provided us with technical comments, which we incorporated as appropriate.

FEMA generally concurred with our recommendation that it take steps to ensure that FEMA's rate-setting methods result in full-risk rates that accurately reflect the risk of losses from flooding, but expressed two reservations. First, it said that the report taken as a whole presents a view of the accuracy of the current FEMA rate-setting process that is "far too negative," especially given the complexity and difficulty of setting flood insurance premium rates. We recognize that determining full-risk

premium rates for flood insurance is an inherently challenging process, especially given the potential for catastrophic losses in any given year. However, in objectively reviewing the rate-setting process and applying generally accepted principles of insurance and actuarial rate setting, we found a number of areas that, when considered collectively, raise questions about the accuracy of the resulting rates and highlight areas that warrant additional analysis by FEMA. For example, for the period of 1978-2003, prior to the catastrophic losses resulting from the hurricanes of 2005, the low to moderate full-risk zones had a cumulative deficit of approximately $685 million. This deficit would seem to indicate that the rates for these risk classes were not adequate to cover the expected losses—a basic actuarial principle. And while the entire full-risk portion of the program did have an overall surplus of approximately $382 million over the same period, this would appear only to indicate the existence of a large cross subsidy between the rated zones, which reinforces our recommendation that FEMA revisit its nationwide class-rating system.

Second, FEMA said that the report does not accurately present the status of its map modernization efforts and their impact on premium rates. Specifically, with respect to map modernization, FEMA stated that (1) our characterization of the progress on the updating of flood maps was misleading; (2) we overstate the impact of older maps on rate setting; and (3) we failed to note that FEMA allows communities to reflect future conditions in flood maps the communities help develop. With respect to the progress of map modernization, FEMA provided the data that we presented in the report, which represents a status of modernization efforts to date. FEMA appears to take issue with measuring the status of map modernization in terms of the number of flood maps that had been updated. We note that in its comment letter, FEMA analyzed progress in terms of the population living within areas covered by updated maps. Each form of analysis provides a different picture of the progress of map modernization, and we have now added FEMA's data to reflect population measures in order to present an additional perspective. With respect to the impact of older maps on rate setting, FEMA states that older maps are not always outdated, and that in many areas the flood hazard has not changed or is possibly decreasing. While some maps may not have changed over the past 10 to 15 years, it is uncertain how many maps fall into this category and FEMA provided no analysis to support this contention. In addition, as we note in our report, FEMA stated that it undertook map modernization for several reasons, including that flood hazard conditions are dynamic and many flood maps may not reflect recent development or environmental changes; updated maps can take advantage of revised data and improved technologies for identifying flood hazards; and up-to-date maps support a flood insurance program that is

more aligned with actual risks. These reasons would seem to reflect a concern that older maps can become outdated. Moreover, we also note that FEMA plans to update its maps every 5 years to make sure they remain accurate. With respect to allowing communities to voluntarily reflect future conditions in flood maps, we were not made aware of these efforts in time to evaluate them for inclusion in this report but we plan to review these efforts in future work. FEMA had additional comments on how we characterized its rate-setting process. We address these comments below.

First, FEMA stated that our finding that probability curves for floodwaters exceeding a specific elevation had not been updated since the 1980s was unfounded because these probabilities are relative to the base flood elevation (BFE), and BFEs are revised as flood maps are updated. As we noted in our report, flood risk experts told us that flood probabilities are likely to change as land use, infrastructure, and weather patterns change. As a result, even if the probability curves are adjusted to reflect a new BFE, other changes since the 1980s could result in the probability curves themselves no longer being accurate. FEMA stated that it prepared a sensitivity analysis that showed that reestimating the probability curves would have a minimal impact on rates. We were not provided this analysis until FEMA gave us its comments on this report, and therefore cannot comment on the accuracy of the analysis. Nonetheless, it illustrates the type of analysis that FEMA should perform periodically to ensure the integrity of its rate-setting process and are encouraged by this effort. Finally, while we understand that the data used to develop probability curves were based on detailed engineering studies, available flood data, simulations, and professional judgments, neither FEMA nor the Corps was able to provide us with the specific data set used to develop the original probability curves. As a result, we could not review the reliability of those data.

Second, in response to FEMA comments about the Corps' use of the hydrologic model that underlies FEMA's flood insurance rate-setting process, we have clarified the language in our report to make clear that while the Corps has revised its model for estimating flood damage, it continues to use the hydrologic model.

Third, FEMA stated that we dismissed its contention that it is adequately pricing the premiums for the class of business that includes grandfathered properties. Considering the class of grandfathered properties as a subset of policyholders, owners of grandfathered properties pay less than full-risk premiums. Although FEMA may raise premiums for others to compensate for the potential shortfall from this subset, the extent and effect of this

cross-subsidization deserves scrutiny and should be analyzed. FEMA concurred with our recommendation to gather additional information on grandfathered properties and analyze their financial impact on NFIP.

Fourth, FEMA challenged our discussion about the number of risk groups used for rate setting and contended that we failed to consider the complexity and cost of using more refined risk classifications. We did recognize and consider the challenges associated with using more refined risk groups and therefore did not specifically recommend that FEMA change its risk rating system. Instead, we recommended that FEMA reevaluate its practice of aggregating risks across zones in light of the program's expansion to determine whether the current risk groups are still relevant. As we noted in our report, FEMA has not revisited its class rating approach since its inception, when it had around 2 million policyholders. The program currently has over 5.5 million policyholders. Since then, there have been significant changes in both the number and location of properties insured by NFIP that would warrant revisiting of FEMA's approach to aggregating risks.

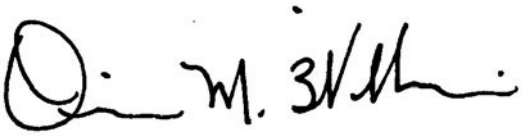
Finally, concerning our analysis of historical claims data, FEMA commented that we did not compare historical losses across states to a theoretical distribution and stated that it believed that the distribution we observed could be explained by analyzing the interaction of the variability of flood risk and the declining number of policyholders receiving discounted premiums. However, FEMA provided no analytical basis for this belief and has not conducted any such analysis to support this assertion. Moreover, FEMA also commented that until such analysis is done, it cannot be sure of the results. We would encourage FEMA to build upon our analysis and continue to explore ways to leverage existing data to evaluate the effective of its rate-setting process and identify ways to strengthen the process. In addition, FEMA expressed its disappointment that we did not include the results of our analysis of losses across states in our report. While we included a shorter version of this analysis in the body of the report, we continued to present the full results of our analysis in appendix II of the report.

As agreed with your office, unless you publicly announce the contents of this report earlier, we plan no further distribution of this report until 30 days from the report date. At that time, we will provide copies to the Chairman, Senate Committee on Banking, Housing and Urban Affairs; the Chairman and Ranking Member of the Senate Committee on Homeland Security and Governmental Affairs; the Chairman and Ranking Member of the House Committee on Financial Services; the Chairman and Ranking

Member of the House Committee on Homeland Security; and other interested committees. We are also sending a copy of this report to the Secretary of Homeland Security and other interested parties. In addition, the report will available at no charge on our Web site at http://www.gao.gov.

If you or your staff have any questions regarding this report, please contact me at (202) 512-8678 or williamso@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made major contributions to this report are listed in appendix IV.

Sincerely,



Orice Williams
Director, Financial Markets and
Community Investment

Appendix I: Scope and Methodology

To assess the Federal Emergency Management Agency's (FEMA) rate-setting process and determine whether it produces rates that accurately reflect the risk of flooding for properties that do not receive subsidies, we reviewed and analyzed FEMA's model for evaluating potential flood damage to properties as well as the methods used for assessing risk and setting premium rates for policyholders. We discussed FEMA's method for rate setting with officials from FEMA, the National Oceanic and Atmospheric Administration, U.S. Army Corps of Engineers (the Corps), and the U.S Geological Survey. We met with risk-modeling agencies, academics and the American Academy of Actuaries to obtain views on FEMA's model and information on private sector flood-risk-modeling methods and data sources. We met with FEMA officials to obtain relevant information and data on FEMA's Map Modernization program. We reviewed FEMA documents and met with FEMA officials in order to understand FEMA's process and policies for grandfathering properties and the impact on the program. We analyzed FEMA's premiums and claims data to determine the number of high-loss years on a state-by-state basis in order to assess each state's financial impact on NFIP. In order to conduct the state loss analysis, we reviewed the claims and premium data from NFIP's BureauNet database. For premium data, we used "Historical Policy Summary" and "All States" each year, individually from 1978 through 2007. For the claims data, we used "Claims Data Summary" and obtained Closed Claims, CWOP, and Open Claims by using the "State Name" and "Calendar Year" sort fields. These numbers were then adjusted for inflation using historic calendar year gross domestic product (GDP) data. Finally, we subtracted claims values from the premiums values, and sorted the states by the number of years in which each state experienced a high-loss year, or a year in which claims exceeded premiums. We also calculated aggregate inflation adjusted claims amounts for each state. Because of the catastrophic effects of the 2005 hurricanes, we also calculated pre-Katrina (1978 through 2004) numbers, which were displayed in table 3. To assess the impact of the rate-setting process and other factors on NFIP's long-term financial stability, we interviewed officials to obtain specific information on NFIP's current and past financial status. We also collected and analyzed information on NFIP's financial status and reviewed existing FEMA documents.

To evaluate the process that NFIP uses to set subsidized rates, we interviewed officials from FEMA to obtain the methodology used to assess total premium needs and set subsidized rates. We collected and analyzed information on FEMA's process for setting rates for subsidized flood insurance and reviewed documents on NFIP program subsidies and recommendations to eliminate them. We also reviewed academic and

other studies of studies of flood risk and flood insurance including reviews from the Congressional Research Service and the Congressional Budget Office.

We conducted this work from December 2007 to September 2008 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We note that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Appendix II: State-by-State Analysis of Claims and Premiums Data

Because rare but large events can account for a large portion of the long-term aggregate experience, we supplemented the aggregate data analysis with the annual high-loss year analysis. Nevertheless, on a cumulative basis for 1978-2004, a period before Hurricanes Katrina and Rita policyholders in several states received markedly more in claims paid out than NFIP collected from them in premiums.[1] Five of the nine states with at least 8 high-loss years—Alabama, Missouri, Mississippi, Texas, and West Virginia—had more in aggregate claims than policyholders paid out in aggregate premiums. Five other states—Kentucky, Minnesota, North Carolina, North Dakota, and Oklahoma—had aggregate claims exceeding aggregate premiums, all of them experiencing between 5 and 7 high-loss years. By expanding the totals to include all years through 2007, Louisiana joins the other nine states with aggregate claims exceeding aggregate premiums, primarily because of Hurricanes Katrina and Rita. On the other extreme, three states—California, Florida, and New Jersey—had aggregate premiums exceed aggregate claims by more than $1 billion, with Florida having an $8 billion surplus.

Table 4: Claims and Premiums Data (in constant 2007 dollars), 1978–2007

State	1978-2004 Premiums minus claims	1978-2007 premiums minus claims	1978-2007 Number of years that claims exceeded premiums
Missouri	($384,344,855)	(350,344,220)	11
West Virginia	(146,896,812)	(118,874,830)	11
Mississippi	(40,584,822)	(2,498,544,520)	10
Louisiana*	428,383,041	(11,777,260,456)	10
Texas*	(728,796,632)	(222,265,084)	9
Alabama	(505,212,107)	(746,166,995)	9
Illinois	90,321,291	162,050,972	9
Ohio	101,547,985	100,111,514	9
New Hampshire	36,648,547	21,531,170	8
Oklahoma	(18,199,240)	(25,642,039)	7
South Dakota	5,295,971	8,404,092	7
Kansas	20,948,695	20,247,134	7
Washington	85,320,803	66,244,958	7

[1]We found qualitatively similar results for the period 1978-2007, which includes the effects of Hurricanes Katrina, Rita, and Wilma.

State	1978-2004 Premiums minus claims	1978-2007 premiums minus claims	1978-2007 Number of years that claims exceeded premiums
Indiana	131,316,681	166,958,946	7
North Carolina	(169,814,330)	(8,457,439)	6
Minnesota	(63,190,911)	(52,511,837)	6
Arkansas	52,001,936	74,966,251	6
Pennsylvania	84,458,562	23,509,354	6
Connecticut	209,580,515	266,043,856	6
North Dakota	(111,305,692)	(103,851,773)	5
Kentucky	(56,850,302)	(42,009,555)	5
District of Columbia	1,030,982	1,734,592	5
Maine	39,784,737	46,807,732	5
Tennessee	47,004,528	82,337,301	5
Virginia	60,909,715	172,548,603	5
Rhode Island	127,856,579	152,323,748	5
New York	574,475,012	648,183,499	5
Iowa	15,016,861	32,394,824	4
Massachusetts	165,750,753	227,224,840	4
New Jersey*	1,071,199,191	1,271,686,111	4
California*	2,042,968,575	2,431,519,768	4
Montana	20,618,089	26,387,334	3
Maryland	63,198,089	139,162,073	3
Wisconsin	68,781,850	90,093,940	3
Nebraska	77,523,305	98,540,480	3
Delaware	79,318,937	115,022,170	3
Michigan	173,141,113	222,803,680	3
Hawaii	185,512,050	245,450,036	3
Arizona	204,216,092	251,713,046	3
Georgia	265,586,974	389,183,828	3
Utah	15,372,336	21,207,776	2
Wyoming	16,597,320	21,134,460	2
Nevada	70,283,808	82,293,838	2
Vermont	23,425,436	30,590,342	1
Idaho	32,991,914	42,892,136	1
Oregon	104,014,018	133,186,375	1
South Carolina	313,400,772	590,371,633	1

State	1978-2004 Premiums minus claims	1978-2007 premiums minus claims	1978-2007 Number of years that claims exceeded premiums
Florida*	8,035,673,802	9,938,638,592	1
Alaska	23,003,446	27,770,628	0
New Mexico	79,909,374	97,876,034	0
Colorado	$135,763,975	$170,139,136	0

Source: GAO analysis of FEMA data.

Note: We analyzed two time periods so we could separately consider the impact of the 2005 Hurricanes Katrina, Rita, and Wilma. *Denotes the five states with the highest number of subsidized policies.

As noted in the report, additional study would be required to determine whether policyholders in some states with lower losses are paying a higher premium than is appropriate for their risk, and others paying too little. For example, our analysis did not control for differences in the type of policy purchased, such as the mix of certain property types across states and insurance coverage amounts, which could affect both premiums and claims. In addition, we did not control for differences in the mix of subsidized and full-risk policies or the impact of subsidized premiums on our results, which could also affect the results. For example, some states have a relatively large number or proportion of subsidized properties (including grandfathered properties) that generally would lead to higher expected claims relative to premiums, but we were unable to link the separate NFIP claims and premiums data at the state and zone levels in a way that would allow us to perform a more refined analysis. The limitations in setting full-risk rates that we have discussed could result in systematic mispricing relative to risk that becomes apparent only over long periods; however, our analysis included both subsidized and full-risk properties, and so the results should be considered in this context.

Appendix III: Comments from FEMA

Washington, DC 20528

Homeland Security

October 14, 2008

Ms. Orice M. Williams
Director
Financial Markets and Community Investment
U.S. Government Accountability Office
441 G St., NW
Washington, DC 20548

Dear Ms. Williams:

The U.S. Department of Homeland Security (DHS) appreciates the opportunity to review and comment on the U.S. Government Accountability Office's (GAO) draft report GAO-09-12 titled *FLOOD INSURANCE: FEMA's Rate-Setting Process Warrants Attention* (250387).

While the GAO raises valid concerns, DHS believes that the analysis does not grasp some generally accepted principles of insurance and actuarial rate-setting and misrepresents the status of the Map Modernization effort and its impact on rate adequacy. We appreciate GAO presenting a generally accurate description of the methodology and National Flood Insurance Program (NFIP) premium rates. Few individuals understand the model and methodology and we appreciate GAO staff learning many of the intricacies of the rate-setting process. The report has made a number of constructive suggestions, some of which DHS is actively pursuing, others that we will take under advisement and, as discussed below, a few with which we disagree.

GAO raised concerns in several areas of the NFIP rate-setting methodology, including: (1) data quality of probability estimates, claim severity estimates, and maps; (2) future conditions impacted by climate change, erosion, and future development; and (3) underwriting results. DHS believes that GAO is overestimating the potential impact of each of these areas. Below, is our response to the major points highlighted in the report; they are sorted by the headings used in the report.

Data Used to Determine Flood Probabilities Have Not Been Updated Since the 1970s and 1980s

GAO expressed concern that the probability curves for floodwater exceeding a specific elevation had not been updated since the 1980s. Since these probabilities are expressed relative to the Base Flood Elevation (BFE), GAO concerns are unfounded. As flood maps are updated to reflect revised BFEs, the PELV curves are automatically re-benchmarked to the revised BFEs. Since the various PELV curves for zones A01 through A30 are based on the relative elevation difference between a "10-year flood" and a "100-year flood" it is very likely

that the floodwater depths for the "250-year flood" or the "500-year flood" remain stable within a specific zone. If the water depth for the "500-year flood" changes significantly in relation to the BFE, then it is likely that the "10-year flood" has also changed in relation to the BFE, resulting in a flood zone change. When the zone changes, the PELV associated with the new zone would be reflected in the appropriate probabilities. FEMA updates its probabilities by re-estimating the annual chance of exceeding the one percent flood (i.e., the BFE). FEMA prepared a sensitivity analysis of the impact on rates and preliminarily concluded there would be a minimal impact.

The Claims Data Used in the Model May Be Inaccurate

Water Depth Data

FEMA agrees with the suggestion to improve the collection of data on water depth in the structure. GAO correctly describes FEMA's method of handling claims where the depth of water is missing or erroneously reported as zero in the claims database. As GAO notes, the effect will be to overstate the flood damage for flood events with only a few inches of water in the structure. However, GAO points out that the impact is unknown for the flood events of greater water depth. FEMA believes this is worth investigating and will conduct a sensitivity analysis of the impact of this type of claim on the rate setting method. As the GAO report points out, FEMA has reviewed the impact of such errors in the past and believes that they generally would result in more conservative premium rates.

Army Corps of Engineers Use of NFIP Claims Data

GAO contends that the United States Army Corps of Engineers (USACE) has moved away from the hydrologic model that underlies the NFIP rate model and developed independent damage estimates for their use.

We reviewed the USACE document ER-1105-2-101. We disagree with the characterization that it no longer relies on the hydrologic model described in FEMA material. The document describes the change they made to their methodology. The "Standard Project Flood" (SPF) is defined in several documents. In the context of ER 1105-2-100 and risk analysis guidance, the SPF is no longer a valid design target. Instead, a full range of floods, including those that would exceed the SPF is to be used in formulation and evaluation of alternatives. Based on that description, we believe that their revision now much more closely follows FEMA methodology. The USACE's historical methodology seems to model only one possible loss event, which they labeled the SPF. By contrast, the NFIP Rate Model has always considered "a full range of floods" by use of the PELV and PELV500 curves. Instead, based on our read of that document, it appears that the U.S. Army Corps of Engineers has revised its model to resemble closely the NFIP Rate Model. We believe that new approach, which considers a full range of floods, is a much more robust approach which is the reason why we have always used it.

GAO states that "As a result [of NFIP claims data quality issues], the Corps began to collect its own damage data, which FEMA now uses to supplement its own data." It is true that FEMA has always used the USACE's data to supplement NFIP claims data where NFIP claims data is too thin to be actuarially credible. However, we provide in Table 1 an analysis of the previous and newly revised USACE data compared to NFIP claims data. It appears

either that the USACE is still using NFIP data or that the alternative data that they now use is very similar to NFIP data.

Table 1 - Comparison of USACE Studies to NFIP Data
One story, no basement structures
Percent damage by depth

Depth	1973 USACE Study	Revised USACE Study	NFIP Experience
-1	-	2.50	11.23
0	7.00	13.40	19.52
1	10.00	23.30	22.34
2	14.00	32.10	31.16
3	26.00	50.10	37.55
4	28.00	47.10	48.26
5	29.00	53.20	60.11
6	41.00	58.60	58.43
7	43.00	63.20	70.50
8	44.00	67.20	68.73
9	45.00	70.50	72.23
10	46.00	73.20	79.68

Maps that Provide Information for Base Flood Elevations Remain Substantially Out-of-Date Despite Modernization Efforts

Maps will never be fully up-to-date everywhere in the country and thus never fully reflect the current flood risk. FEMA believes that GAO significantly understates the overall quality of current maps and, as a result, is over-estimating the possible impact of these older maps on pricing. FEMA believes that the Hydrologic Rate Model used in estimating rates has sufficient additional conservatism to compensate for these factors and can state with confidence that the premiums from the Rate Model are a reasonable estimate of the full risk premium based on the full range of flood loss probabilities.

FEMA is concerned that the figures GAO references regarding the number of maps that are at least 5, 10, or 15 years old may be misleading. Many of those maps are still being updated as part of Map Modernization. It generally takes between two to three years to finalize flood map changes in coordination with state and local governments. That being the case, current map age can be misleading. As of March 2008, approximately 68% of the nation's population has already received updated maps that met, exceed, or at least approach the map quality targets of Map Modernization, while another 27% of the population has received a preliminary map. By the end of FY 2010, FEMA anticipates that at least 92% of the nation's population will have a modernized flood map.

GAO seems to have a concern that an old map is an incorrect map that understates the flood risk and therefore adversely affects insurance pricing. Older maps are not always outdated. In many areas with older flood maps, the flood hazard has not significantly changed or is

possibly decreasing. Further, there are instances where areas have not been re-studied because the stream gauge or historical data does not include any new flooding events, even of small magnitude, so there is no additional data with which to update the maps.

GAO has also expressed concern about the possible deterioration of a map's quality between the scheduled five-year update. While this happens in some areas of the country for a variety of reasons, it is also true that some States or local communities attempt to lessen the impact of the changes in the flood risk. When deterioration of the flood risk occurs, local communities are required to communicate to FEMA as soon as practical, but no later than six months, appropriate data to use to update the community's maps to reflect current flooding conditions. In this way, FEMA assures that maps are updated more frequently than every five years to reflect changing conditions. These and other changes to the maps are usually done through the Letter of Map Amendment/Letter of Map Revision process. These amendments and revisions currently average about 22,000 a year.

GAO fails to note the advancements FEMA has made in allowing communities to reflect future conditions in maps they develop. Currently, communities can choose to use future conditions hydrology for mapping per a Federal Register notice published on November 27, 2001. Future conditions hydrology are based on projected land-use conditions of the watershed, which could increase surface water runoff such as an increase in impervious areas created by future parking lots or structures or future construction/improvement of drainage networks that accompany urbanization. While FEMA does not require future conditions mapping, we are working to encourage local communities to adopt it voluntarily through these procedures and through NFIP Community Rating System credits.

FEMA Does Not Track the Number or Location of Remapped Grandfathered Properties That Pay Less Than Full Risk Premiums

The report correctly describes the current FEMA program of grandfathering currently. GAO acknowledges FEMA's belief that it is adequately pricing the premiums for the class of business which includes the grandfathered policies because the methodology that the NFIP uses in setting rates for the X-Standard risk group includes these grandfathered properties. However, GAO dismisses this contention. We allow X-Standard policies to continue to use the X-Zone for rating purpose but set the overall premium level that we estimate to reflect the full-risk of that risk group as a whole. The report does not mention that the grandfathered X-Standard premium is substantially higher than the previous X-Preferred Risk that most of these policyholders had been charged. FEMA provided GAO premium charts that showed that the X-Zone standard premium is now higher than the premium for some AE-Zone compliant structures. In addition a significant portion of these grandfathered policies are older Pre-FIRM policies that would be eligible for subsidized premiums and would no longer be part of a risk class that is charged on average their full-risk premiums.

FEMA Does Not Consider Risk Factors Such as Erosion and Climate Change When Setting Flood Insurance Rates

Although FEMA has not investigated the issue of climate change and its impact on the NFIP in totality, we conducted a study in 1991 that focused on one aspect of climate change, sea level rise. The study, titled *Projected Impact of Relative Sea Level Rise on the National*

Flood Insurance Program[1], concluded that the NFIP would not be impacted significantly under sea level rise scenarios put forth in the first Intergovernmental Panel on Climate Change (IPCC) report released in 1990. FEMA has initiated a new study on climate change titled, *Impact of Climate Change on the NFIP and Improving Coastal Floodplain Mapping*. The study will include an investigation of the impacts of sea level rise, changes in hurricane frequency and intensity, and changes in precipitation patterns and how they might affect the NFIP. FEMA will use the latest information contained in the most recent IPCC and Climate Change Science Program (CCSP) projections and findings in the conduct of this study. We expect to complete the study in early 2010 and will carefully evaluate its findings to determine how to best account for climate change in setting flood insurance rates.

In the absence of the authority to establish erosion zones, FEMA has taken actions based on the Heinz Center[2] study on coastal erosion, which projected increased damages due to the effects of long-term coastal erosion over a 60-year period. We have increased rates for all V-Zone properties at a pace commensurate with the Heinz Center projections, since we cannot explicitly identify those properties most at risk from erosion.

The FEMA Rating System Combines and Averages Many Different Risks to Create Nationwide Rates

GAO concerns regarding the current amount of risk groups are misplaced. GAO correctly notes that the flood risk for individual policyholders varies within the current risk groups. This is also true for risk groups in the private insurance industry. In establishing risk groups, FEMA must balance the administrative complexity of a highly refined number of risk groups against the degree of heterogeneity of risk within those groups. FEMA continues to believe that we have found the appropriate balance. GAO does not consider the amount of complexity that their recommendation for more highly refined risk groups would create. The size of the rate manual would increase many-fold, as would the difficulty of making accurate zone determinations in those communities that have a variety of A-numbered zones.

FEMA has considered the implications on our current risk group classifications if future legislative changes require the NFIP to reduce significantly the classes of buildings that are eligible for premium subsidies. Whereas, the current risk groups may not result in significant cross-subsidization among compliant structures that will probably not be true for older non-compliant structures. Simply extending the current practice of manually rating non-compliant structures to these older structures, will not work since FEMA does not have the staff to support the increased workload. FEMA has begun considering how to revise its rate structure if future subsidy reduction is mandated.

Our Analysis of Historical Claims and Premium Data Raises Questions about a Potential Mismatch between Rates and Risk

GAO conclusions from this analysis appear to inject its expectations as to how the results should have behaved if rates were actuarial. We believe the NFIP actual experience compares to estimates of the theoretical distribution, which GAO did not do. Unfortunately, FEMA did

[1] FEMA, *Projected Impact of Relative Sea Level Rise on the National Flood Insurance Program*, October 1991, available at http://www.epa.gov/climatechange/effects/downloads/flood_insurance.pdf.
[2] The Heinz Center, *Evaluation of Erosion Hazards*, April 2000, available at http://www.fema.gov/pdf/library/erosion.pdf.

not have time to develop a theoretical distribution to make this comparison. We believe that the distribution of the results that GAO observed in their analysis is explained by understanding the interaction of the variable flood risk and the greatly declining percentage through the years of policyholders who receive discounted premiums. However, until a more refined model is constructed, we will not know which is correct.

GAO had prepared an analysis of how often the annual loss experience for a state was above or below the median result for the year. We were disappointed to see GAO did not include this analysis in the report. FEMA believes that with more refinement and adjustments the analysis had the potential to be useful.

The FEMA Process for Setting Subsidized Rates May Further Compromise the Ongoing Financial Stability of the Program

The report is critical of FEMA methodology for setting the premium rates for the subsidized policies. The process used to set subsidized rates has evolved over time, and the report accurately describes the current process. We consider many factors in setting subsidized rates, and the 2005 hurricanes have had a major impact on those considerations. FEMA is in the process of reviewing its methodology with respect to the premium rates of the subsidized business. We are looking for guidance from the Congress on who should continue to be eligible for subsidized rates and the level of subsidy provided to them.

DHS generally concurs with both of the report's recommendation with two reservations. Following are our recommendation-specific comments; technical comments were provided under separate cover.

GAO Recommendation 1: We recommend that FEMA take steps to ensure that its rate setting methods and data used to set rates result in full-risk premiums rates that accurately reflect the risk of losses from flooding. For example, verifying the accuracy of flood probabilities, damage estimates, and flood maps; ensuring that the effects of long-term planned and ongoing development, as well as climate change, are reflected in the flood probabilities used; and reevaluating the practice of aggregating risks across zones.

DHS Response: Concur with reservation. In general, FEMA concurs with the first recommendation with two reservations. One, the GAO commentary taken as a whole presents far too negative a picture of the accuracy of the current NFIP pricing model and methodology. FEMA notes that the NFIP rate-setting process has evolved over a number of years and is dependent on many complicated inputs, estimations, modeling techniques and actuarial judgments. This type of process is always an inexact science, and we are always looking for, and will continue to incorporate, improvements in each of those areas as the needs and our resources allow. Two, FEMA believes that the report does not accurately present the status of the Map Modernization effort and its impact on rate adequacy.

There are many lines of insurance where precise measurement is practically impossible. As an example, in Workers' Compensation insurance there is uncertainty as to how workplace safety will vary over time due to technological advancements, workplace safety measures, the size of court awards to injured plaintiffs, future interest rates that will affect benefit levels, and future medical costs. The challenges and practical impossibility of precisely quantifying these factors do not mean that workers compensation insurance is not actuarially sound.

Rather in workers compensation insurance, like flood insurance, actuaries make judgments to establish rates that deal with a variety of uncertainties. Like Workers' Compensation insurance, where there is imprecision in estimating the parameters of the Rate Model or in the application of those indicated rates in the real world of selling flood insurance, FEMA actuaries have a history of consulting with other subject matter experts, such as hydrologic and/or hydraulic scientists, and the building science and mapping experts within FEMA. This has allowed them to estimate appropriately the impact of these parameters of the rate model.

GAO Recommendation 2: We also recommend that the Secretary of Homeland Security direct FEMA to ensure that information is collected on the location, number, and losses associated with existing and newly created grandfather properties in NFIP and to analyze the financial impact of these properties on the flood insurance.

DHS Response: Concur. DHS agrees with the need to start identifying the number of grandfather policies. While there are sound public policy reasons why the NFIP introduced and has maintained its grandfathered policies, there are also benefits to charging these policyholders a premium that is close to their specific risk instead of a premium based on a wider class of risks. Such as change would more fully communicate to the property owner the flood risk faced and encourage the property owner to take action to reduce that risk.

We are implementing a data collection effort for all newly grandfathered policies effective on or after May 1, 2009. However, collecting such data on currently insured structures is far more difficult. FEMA intends to work out a methodology to do that and to develop the financial analysis recommended.

FEMA believes that the NFIP rate setting process is sound and is conducted in accordance with the body of statutory and regulatory authority governing the NFIP and within the standards of actuarial practice and acknowledge there is always room for improvement. We thank the GAO staff for presenting in this report a number of constructive suggestions for improvements in our rate-setting process.

U.S. Department of Homeland Security would like to thank you for the opportunity to review and provide comments on the draft report. We look forward to working with you on future homeland security issues.

Sincerely,

Jerald E. Levine
Director
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Appendix IV: GAO Contact and Staff Acknowledgments

GAO Contact

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Staff Acknowledgments

In addition to the contact named above, Lawrence Cluff (retired) and Patrick Ward, Assistant Directors, Nima Patel Edwards, Christopher Forys, Emily Chalmers, Martha Chow, Melvin Thomas, Joseph Applebaum, Tania Calhoun, Christopher Krzeminski and Rudy Chatlos and Richard Vagnoni made significant contributions to this report.